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appearance, the subject is still open. Their conclusions may be quite correct, but examination from external appearance does not prove it. One great trouble arising in the discussion of this subject is that the destruction of the object consequent upon analysis and thin section prevents a satisfactory and competent determination.

MICROSCOPY.¹

A Method for Injecting the Blood-Vessels in Birds.—

I presume all who give a laboratory course in Comparative Anatomy have, in common with myself, experienced difficulty in injecting the arterial and venous systems of birds. The usual directions are to inject the arterial system through the pectoral artery, and the venous system either through the pectoral vein or through the coccygeo-mesenteric vein. The blood of birds coagulates very rapidly, and even when the procedure is carried out as expeditiously as possible, failure frequently occurs from the inability of the operator to remove the greater part of the blood from the animal, or from vexatious delays in tying a canula in the divided vessel. For some time I have been using the following method, and have not failed in securing the most satisfactory results. It possesses the additional advantage of being quickly performed.

The bird, a pigeon for example, is placed under a bell-jar and chloroformed in the usual way. While the bird is getting under the influence of the anesthetic, the operator should see that there is, within convenient reach, a scalpel, a pair of stout scissors with both points rounded off, two canulae and the necessary ligatures for tying them in place.

As soon as the pigeon is thoroughly under the anesthetic, the bell-jar is removed, a towel is wrapped about the head and a few drops of chloroform poured over it; the feathers are rapidly plucked from the breast and abdomen to a point just anterior to the cloaca; the skin is divided the entire distance over the keel, and the pectoral muscles dissected off from their attachment to the keel and body of the sternum for a distance of half an inch on either side of the keel.

The muscles attached to the posterior margin of the sternum are next divided close to the sternum for the distance of half an inch on either side of the median line; now raise the sternum carefully and divide the attachment of the heart. Beginning at the outer angle of the divided abdominal muscles, the body of the sternum is cut through

¹This department is edited by C. O. Whitman, University of Chicago.

with the stout, blunt-pointed scissors, in a direction forward and inward, until a point is reached directly over the origin of the vascular trunks; repeat on the opposite side. Now grasping the keel firmly with the left hand, make traction directly upward, at the same time steadying the bird with the right hand; by this procedure the sternum is broken equally across, and the heart exposed without causing any damage to it or to the vascular trunks. Next, tear the pericardium open as quickly as possible, seize the heart, still strongly beating, between the thumb and index finger of the left hand, invert the bird over a sink and cut off with the blunt-pointed scissors the apex of the heart. In this way the blood-vessels are thoroughly emptied and the bird killed without any unnecessary suffering.

Although the description of the procedure may make it seem long, I have repeatedly done it in less than three minutes.

A canula is now inserted through the left ventricle into the aorta, and a ligature placed around it close to the point where the aorta leaves the heart. In passing the ligature around the canula, care should be exercised not to injure the vena cava or the right auricle. A second canula is passed through the right ventricle into the right auricle and secured by tying a stout ligature about the whole heart.

I have found that the best injecting mass is Gage's modification of Pausch's, colored with vermilion or ultramarine blue; this does not pass through the capillaries, sets quickly, leaving the vessels well-distended with a firm mass.

I employ a constant pressure apparatus in injecting, using a pressure of 100 mm. for the artery, but only 60 mm. for the vein; more than this will usually cause a rupture.

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